



ARMSTRONG

LABORATORY

**PSYCHOLOGICAL CHARACTERISTICS OF
UNITED STATES AIR FORCE PILOTS**

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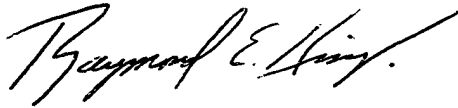
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This technical report has been reviewed and is approved for publication.



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PREFACE

The Army Aviation Flight Program opened to women in 1973 (23). On 7 October 1975, President Gerald Ford cleared the way for women to enter the service academies (22). Women began training as pilots and navigators in the United States Air Force (USAF) in 1976 (11) and became US Navy flight officers in 1979 (2). The Department of Defense lifted the Combat Exclusion Clause in 1993, clearing the way for women to potentially fly in aerial combat.

The Defense Women's Health Research Program (DWHRP) is a three year Congressionally funded project to study the health needs of military service women; it is administered by the US Army Medical Research and Materiel Command. *Assessment of Psychological Factors in Aviators*, the subject of this Technical Report, received funding through a competitive grant application to the DWHRP in the amount of \$90,566. The grant proposal was submitted by then-Major Christopher F. Flynn with Major Suzanne E. McGlohn and then-Captain Raymond E. King as co-investigators. Upon Dr. Flynn's separation from the USAF, Major McGlohn and Major King served as co-principal investigators and were joined by Paul D. Retzlaff, Ph.D., who was sponsored by the Air Force Office of Scientific Research Summer Visiting Faculty Program.

The Armstrong Laboratory Advisory Committee on Human Experimentation reviewed the protocol and assigned the approved protocol the number AL ACHE 94-29, while Headquarters United States Air Force tracked the study as protocol R95-022. The protocol was greatly aided by the support of the Surgeon General of the Air Force (Appendix A) and the Chief of Staff of the Air Force (Appendix B).

The investigators adhered to policies regarding the protection of human subjects as prescribed by 32 CFR 219 and Subparts B, C, and D. Opinions, interpretations, conclusions and recommendations are those of the authors and are not necessarily endorsed by the US Army. Furthermore, the opinions presented in this paper are not necessarily those of the Department of the Air Force, Department of Defense, nor the Government of the United States.

The authors acknowledge the invaluable contributions of Victoria M. Voge, M.D., M.P.H., Senior Airman Wilhelmina Cromartie, Senior Airman W. David Taylor, and William M. Weaver.

Psychological Characteristics of United States Air Force Pilots

SUMMARY

This document represents the final report of the protocol entitled *Assessment of Psychological Factors in Aviators*, funded in fiscal year 1995 by the Department of Defense Women's Health Research Program (DWRHP). This protocol studied the psychological and psychiatric health of 64 male and 50 female non-referred United States Air Force (USAF) pilots. A number of psychological tests were administered as well as a structured interview. The Multidimensional Aptitude Battery (MAB), the NEO Five Factor Inventory (NEO-FFI), the Crew Management Attitude Questionnaire (CMAQ), and the Personal Characteristics Inventory (PCI) were presented on IBM ThinkPad computers. While MAB intelligence scores were near identical for men and women, women were found to have higher scores on the *Extraversion*, *Agreeableness*, and *Conscientiousness* scales of the NEO-FFI. CMAQ results, however, suggest no significant male/female "resource management" differences. The semi-structured interview sought information about personal/family health, squadron relationships, and career/deployment stresses. The interview findings suggest the USAF Academy is an important avenue for women to enter military aviation, many young female pilots are delaying childbearing for their aviation career, and the squadron members most often reported as having trouble with mixed-gender squadrons are older male enlisted crew members and male supervisors. An important area for future training proved to be men's desire to protect women in combat.

INTRODUCTION

Background

Although female aviators have been an integral part of military aviation since World War II, little is known scientifically about their psychological make-up. Women comprise a small, but growing, percentage of United States Air Force (USAF) pilots (2% or approximately 315 as of Jan 95). Additionally, test, fighter and light attack pilots, along with astronauts (who are often recruited from these cockpits) are more frequently studied at the expense of tanker and transport pilots (7). Due to the former Department of Defense policy of combat exclusion, the majority of female pilots had been assigned to tanker and transport aircraft. There is a paucity of data on high functioning women in all professions; often data from males is extrapolated to women. Novello and Youssef (15), however, studied 87 general aviation female pilots and found female pilots to be more similar to male pilots than to females in the general population. "Assessment of Psychological Factors in Aviators" (APFA), funded by the Defense Women's Health Research Program, studied traits found in successful pilots; both gender-specific and common to all pilots. Efforts to collect normative data on successful pilots help define the attributes of successful pilots, and allows a better understanding of pilot personality than is possible when relying on information collected from individuals psychiatrically referred. The structure of the paradigm of the "Right Stuff" (25, 17, 20) rests on a male foundation. Do female pilots bring different intellectual skills and personality styles into the cockpit? Siem and Murray

(19) found that experienced pilots rated "conscientiousness" as the most important of the "big five" (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness) personality characteristics determining pilot performance. Siem and Murray advocate research to validate the importance of conscientiousness in actual pilot performance. Picano (16), studied male US Army pilots and concluded there is no single successful pilot personality type. Retzlaff and Gibertini (17) similarly found three distinct personality types among male student USAF pilots. The interest in aviation circles about personality is directly related to selection, training, performance, and ultimately, safety concerns.

Identification of the stresses, if any, of mixed-gender squadrons and recognition of the possible difficulties of balancing a career and family are important in today's USAF. Almost all Air Force cockpits are now open to both men and women. In 1983, Jones (11) first broached questions regarding the impact of female pilots on previously all-male flying squadrons. Through an examination of referrals to the Aeromedical Consultation Service at Brooks AFB, Texas, he found a significant number of male fliers tended to see female fliers in stereotyped roles of mother or sister and then responded to the role rather than the individual. He believed this role projection affected the female pilot's real-life role, and this role-casting could have the potential to affect flight safety. Today, due to the 1993 decision to modify the combat exclusion rule (21), concerns about the effects of mixed-gender squadrons on mission completion and flight safety are even greater.

Purpose

The purpose of the current study was to examine a number of important psychological and psychiatric variables in groups of female and male non-referred USAF pilots. Understanding the differences between genders on intelligence, personality, and psychosocial issues is important to the mental health of not only female pilots but male pilots as well.

METHOD

Participants

One hundred and fourteen pilots (64 men and 50 women) from Air Mobility Command (AMC) and Air Education and Training Command (AETC) participated. Most participants ($n = 108$) were assigned to crewed aircraft (transport/tanker; C-5, C-17, C-21, C-141, KC-10, KC-135). All AETC ($n = 6$) participants were instructor pilots who had a recent history of assignment to crewed aircraft. No men from AETC served as participants to eliminate any former fighter pilots from the sample. One female participant was unable to complete the entire psychological testing battery due to mission demands; computer failure resulted in the loss of another female participant's demographic and psychological testing data. No interview data were lost.

<u>Table 1. Demographics</u>	Women	Men
Mean age	30	29
Mean self-reported military flying hours	1,760	1,712
Mean self-reported combat-support flying hours	43	68
Race*	(Expressed	as percents)
Asian	0	2
Black	2	6
Caucasian	98	89
Other/Wouldn't Identify	0	2
Married		
Yes	53	67
Education		
Bachelors	45	53
Some Grad Work	22	34
Masters	33	10
More than 18 years	0	3
Commissioning source	Women	Men
	(Expressed	as percents)
OTS	12	16
ROTC	31	45
USAFA	55	39
MIMSO	2	0
Military Rank		
O-2	12	9
O-3	71	87
O-4	6	3
O-5	8	0
O-6	2	0

* English first language for all participants
(required for MAB interpretation)

Table 1. Demographics (continued)

Crew position	Women (Expressed	Men as percents)
Co-pilot	41	31
Pilot	20	42
Aircraft Commander	16	9
Instructor Pilot	18	11
Stan Eval	4	6
Private Pilots' License		
Yes	67	66

One hundred and three college undergraduate women from a state-supported university in the western United States served as a control group on NEO-FFI data. While this population does not precisely match the age and final educational level of the female pilots, the "adult" norms in the NEO test manual (5) are probably even less applicable to female USAF pilots.

Apparatus

We used six IBM ThinkPad dual-scan color notebook computers (486DX with 8 Meg RAM) capable of writing entries onto a 3.5 inch DSHD disc. Computer administration allowed confidentiality and anonymity, as well as standardization. The interview data were captured both on paper and a microcassette recorder for backup and verification purposes. All interviews were transcribed and the recording was then destroyed.

Procedure

The investigators provided a briefing for as many potential volunteers as possible explaining the nature of the project, how much time was required, and what was contained in the consent form. Those who remained interested in participating were asked to carefully read, understand, and then sign the informed consent document. This form explained the content and purpose of the study and explained the procedures. The study was completely voluntary and anonymous; consent could be withdrawn by a participant at any time without consequence. All information provided on the consent form is protected by the Privacy Act of 1974, as directed by AFR 169-6. The data on the consent form cannot be linked to interview data, further preserving anonymity. Participants chose a random number; sets of random numbers were used to link the testing data to the interview data. Commanders did not have access to volunteer sign-up sheets or data.

We tested from one to six participants at a time, collected general demographic information, and administered the Multidimensional Aptitude Battery (MAB, 10), the NEO Five Factor Inventory (NEO-FFI, 5), Crew Management Attitude Questionnaire (CMAQ), and Personal Characteristics Inventory (PCI). The MAB is an intelligence (IQ) test, the NEO-FFI is a survey of the normal range of personality functioning, and the CMAQ measures communication and coordination, command responsibility, and recognition of stress effects. The PCI is intended to study crew resource management *potential*. The controls were administered the NEO-FFI as part of their undergraduate psychology course requirements.

A female psychiatrist/flight surgeon (SEM) conducted all of the structured interviews to avoid gender-bias between interviews. The interview is based on an aircrew survey developed by Voge and King (23). The interview required approximately 30-45 minutes to complete. The psychiatrist conducted the structured interviews individually, using a coded checklist and a tape recorder. The checklist was developed using a MicroSoft Access database that contained all the possible answers. The database was modified after the first round of interviews to add additional potential answers as suggested by aircrew. Each volunteer was asked whether she or he verbally consented to recording; their response was documented on the interview sheet. Each volunteer was told the recording would be used to create a transcript of the interview, identified by number only, after which the cassette tape was reused or destroyed.

Upon return to Brooks AFB after each data collection trip, both testing and interview data were added to a secured database. Then a script of each interview was reviewed by the interviewer to ensure the accuracy of the collected data on the checklist. The data was stored in two formats, one using a wide number of possible answers for each question, and a database that included only simple, short choices for the answers.

RESULTS

Psychological Testing

Multidimensional Aptitude Battery. Of the ten subtests of the MAB, only *Information* and *Picture Completion* showed significant female/male differences (with males higher). Female pilots achieved a Verbal IQ equal to 120.0 (5.4 *sd*), Performance IQ equal to 121.7 (7.0 *sd*), Full Scale IQ equal to 122.3 (5.2 *sd*) while male pilots achieved 120.8 (5.6 *sd*), 122.7 (7.3 *sd*), and 123.4 (5.4 *sd*), respectively. Hence, there were no significant male/female IQ differences. The observed lack of expected (9) intellectual differences may be a function of selection (both self-selection and military personnel selection) and assignment.

Table 2. Means and Standard Deviations of MAB.

	Women	Men	<i>F</i> , <i>DF</i> (1,110)
Total IQ	122.3 (5.2)	123.4 (5.4)	1.11
Verbal IQ	120.0 (5.5)	120.7 (5.6)	0.49
Performance IQ	121.5 (6.8)	122.7 (7.3)	0.79
Information	29.6 (4.3)	31.4 (3.7)	5.99*
Comprehension	24.0 (1.8)	23.9 (1.6)	0.09
Arithmetic	15.8 (1.5)	16.0 (1.7)	0.20
Similarities	29.6 (2.3)	29.0 (2.8)	1.26
Vocabulary	34.2 (5.7)	34.4 (5.1)	0.03
Digit Symbol	30.9 (3.3)	29.8 (3.0)	3.06
Picture Completion	26.9 (2.9)	28.3 (2.8)	6.37*
Spatial	36.7 (5.9)	38.5 (6.4)	2.50
Picture Arrangement	11.9 (2.1)	12.5 (1.8)	3.01
Object Assembly	16.1 (2.4)	15.9 (2.3)	0.11

Note: * $p < .05$

NEO-FFI. Women scored higher on the NEO-FFI domains of *Extraversion*, *Agreeableness*, and *Conscientiousness* than the male pilots. Agreeableness and conscientiousness traits are probably at variance from the “right stuff” fighter pilot lore (25). In order to quantify the differences between the female and male pilots multivariately, a stepwise multiple regression was performed with the female pilots coded as “1” and the male pilots as “0”. This technique results in a omnibustic quantification of the profile differences and is more interpretable than a discriminant function analysis. Here, *Agreeableness* and *Conscientiousness* again play a large multivariate role. However, due to the suppression effects of those variables, *Neuroticism* enters the equation as the final and third variable. The total multiple *R* is 0.46 accounting for 21 percent of the variance. The inclusion of *Neuroticism* is probably reflective of non-pathological affect and more in line with an “awareness of feelings.”

Table 3. Means and Standard Deviations of NEO-FFI.

<u>Domain</u>	<u>Women</u>	<u>Men</u>	<u>t value</u>
Neuroticism	14.3 (6.1)	13.4 (6.4)	.72
Extraversion	35.0 (5.9)	32.5 (6.5)	2.12*
Openness	27.9 (5.8)	28.1 (6.4)	-.15
Agreeableness	35.1 (4.9)	31.7 (5.6)	3.37**
Conscientiousness	37.9 (5.9)	35.3 (5.6)	2.30*

Note: * $p < .05$

** $p < .001$

In order to further and better define the personality profiles of female pilots, their scores were compared to those of a control group of female college students. Again, while this population is not an ideal control sample, it is very difficult to find college educated thirty-year-old women in traditional male technical occupations. The data point to significant and often very large differences between the female pilots and the female college students on all five variables. Of particular note is the large difference on *Neuroticism*. Here the female pilots are over a standard deviation below the college student controls. This finding is probably a very stable result as the NEO manual (5) presents norms that are very close to our control sample. The manual presents *Neuroticism* norms for college students and "adults" of 26 and 21, respectively. The female pilots were also less open to experience than the college students. The female pilots, however, were higher on the *Extraversion*, *Agreeableness*, and *Conscientiousness* scales than the students.

The stepwise multiple regression indicated that the *Neuroticism*, *Openness to Experience*, and *Conscientiousness* variables resulted in a multiple R of .62 accounting for a fairly dramatic 39 percent of the variance.

Table 4. NEO-FFI Pilot Regression Summary Table.

Step No.	Predictor Variable Entered	Coefficient	Multiple R	Multiple R ²	Change in R ²	F to Enter
1	<i>Agreeableness</i>	0.0335	0.3058	0.0935	0.0935	11.35
2	<i>Conscientiousness</i>	0.0300	0.3594	0.1292	0.0356	4.46
3	<i>Neuroticism</i>	0.0275	0.4615	0.2130	0.0838	11.50
	Constant	-2.1531				

Table 5. Means and Standard Deviations for Controls.

<u>Domain</u>	<u>Pilots</u>	<u>Students</u>	<u>t value</u>
<i>Neuroticism</i>	14.3 (6.1)	24.4 (7.5)	-8.26**
<i>Extraversion</i>	35.0 (5.9)	32.6 (6.5)	2.18*
<i>Openness</i>	27.9 (5.8)	31.4 (6.6)	-3.12*
<i>Agreeableness</i>	35.1 (4.9)	31.1 (6.0)	4.03**
<i>Conscientiousness</i>	37.9 (5.9)	31.7 (7.4)	5.09**

Note: * $p < .05$

** $p < .001$

Table 6. NEO-FFI Control Group Regression Summary Table.

Step No.	Predictor Variable Entered	Coefficient	Multiple R	Multiple R ²	Change in R ²	F to Enter
1	<i>Neuroticism</i>	-0.0255	0.5605	0.3141	0.3141	68.24
2	<i>Openness</i>	-0.0143	0.5935	0.3523	0.0382	8.72
3	<i>Conscientiousness</i>	0.0129	0.6240	0.3893	0.0370	8.92
	Constant	0.8561				

Cockpit Management Attitude Questionnaire (CMAQ). CMAQ results, however, suggest no significant male/female management differences. It should be noted that while men may have selected their aircraft based on their preference to work as part of a crew (and thus self-selected), the women did not have as many options due to the combat exclusion law in effect at the time of their assignment.

Semi-structured Interview

Several important themes emerged from the interviews, demonstrated by significant differences between the responses of women and men:

Motivation to Fly. Men and women had different factors motivating them to fly. More women chose to enter pilot training because they went to the Air Force Academy and were pilot qualified (34%), while more men chose to enter pilot training because they had wanted to fly since childhood (45%).

Medical Issues. A larger number of women (36%), had been grounded greater than 30 days than men (17%). Women were most often grounded for obstetrical/gynecological reasons (50%) and orthopedic reasons (33%). Men were most often grounded for internal medicine problems (40%) and orthopedic reasons (40%).

Working Relationships. The majority of men and women reported either positive or neutral working relationships with both genders in their squadrons. The squadron members displaying the most problems interacting with women in the squadron were older males, including enlisted crew and some commanders. Of note, although several female lieutenant colonels and a colonel elected to participate in the study, no men of equivalent rank agreed to participate, despite the same invitation. The majority of both men (56%) and women (78%) believed working relationships in their squadron were improved with the presence of both genders. Both men and women believed this improvement was due to the greater access to the broadened perspective of both genders in a mixed-gender squadron.

Career Stresses. Next, a greater number of women reported sexual discrimination as their most significant career stress (16%), as opposed to men, who did not report sexual discrimination as a career stress. When asked to compare their stresses to other members of their squadron, men more often felt women had greater stresses compared to their own (45%), while women felt the stresses of men and women in the squadron were the same (58%).

Prisoner-Of-War (POW) Concerns. Both the majority of men (67%) and the majority of women (82%), believed they were prepared to be POWs. Both men and women cited their training as the reason they felt prepared. Men and women, however, had different concerns about being a POW. Women were concerned with both sexual assault (22%) and being exploited to harm other POW's (20%), while men were concerned with physical harm (31%) and their families' concerns (20%).

Combat. The vast majority of both men (91%) and women (86%) in our study, wanted to fly in combat. Both genders explained their desire to fly in combat stemmed from a desire to fulfill their responsibilities as a pilot. Both men (97%) and women (98%) reported they would feel comfortable flying in combat with both genders. Equal numbers reported they did not notice gender differences in their crews when flying and that aviation standards are performance, rather than gender, based. Both men (87%) and women (80%), believed pilots should not have a choice as to whether or not to fly in combat. The majority of both genders believed pilots should not have a choice because they are obligated to fulfill the mission of the Air Force. The majority of men (73%), however, reported that they would be more protective of a woman in combat while only 6% of women reported they would be more protective of a crew member in combat due to gender. Men cited protection of women as part of their code of ethics as the reason they would be more protective (42%). Men also noted that women are at greater risk of being harmed in prisoner of war situations than men (30%).

Stresses and Stress Coping . Lastly, men (78%) reported more family stresses as a result of their job than women (38%). This difference may be explained by women delaying childbirth; only nine of the fifty women interviewed had children. The majority of these nine women were senior and had chosen to start their families while assigned to non-flying jobs. The younger women reported that they were trying to meet their occupational goals before having children. Stress coping styles were similar for men and women. Women reported exercise (36%) and internalizing problems (12%), as their methods for coping with stress. Men reported the same; 31% cited exercise and 28% internalized their problems as ways to cope with stress.

Table 7. Interview Results.

Question	Men		Women		chi-square	<i>p</i>
	n	%	n	%		
Have you been grounded > 30 days?						
yes	11	17	18	36	5.24	*
no	53	83	32	64		
Would/did grounding affect you?						
yes	52	81	38	76	0.47	
no	12	19	12	24		
Would/did grounding affect your career						
yes	25	39	27	54	2.52	
no	39	61	23	46		

		Men		Women		chi-square	<i>p</i>
Do you have health concerns about your aircraft?		<i>n</i>	%	<i>n</i>	%		
	yes	24	38	24	48	1.27	
	no	40	63	26	52		
Do you have minor physical problems you ignore?							
	yes	8	13	11	22	1.82	
	no	56	88	39	78		
How do working Relationships with colleagues affect you?							
male colleagues							
	positive	22	34	12	24	2.69	
	negative	5	8	8	16		
	neutral	37	58	30	60		
female colleagues							
	positive	18	28	29	58	10.48	*
	negative	5	8	3	6		
	neutral	41	64	18	36		
male supervisors							
	positive	4	6	9	18	21.92	*
	negative	3	5	16	32		
	neutral	57	89	25	50		
female supervisors							
	positive	9	14	10	20	1.40	
	negative	2	3	3	6		
	neutral	53	83	37	74		
male subordinates							
	positive	5	8	4	8	20.47	*
	negative	3	5	19	38		—
	neutral	56	88	27	54		—

		Men		Women		chi-square	p
		n	%	n	%		
female subordinates							
	positive	6	9	13	26	5.59	
	negative	3	5	2	4		
	neutral	55	86	35	70		
How do male colleagues treat you?							
	positive	18	28	2	4	13.67	*
	negative	3	5	8	16		
	neutral	43	67	40	80		
How do female colleagues treat you?							
	positive	10	16	27	54	18.90	—
	negative	3	5	1	2		
	neutral	51	80	22	44		
What is your stress compared to men?							
	same	46	72	23	46	13.15	*
	less	5	8	1	2		
	more	13	20	26	52		
What is your stress compared to women?							
	same	32	50	43	86	19.12	*
	less	3	5	3	6		
	more	29	45	4	8		
How have squadron working relationships changed with both genders present?							
	better	36	56	39	78	7.86	*
	worse	9	14	3	6		
	no change	13	20	3	6		
	unknown	6	9	5	10		

		Men		Women		chi-square	<i>p</i>
		<i>n</i>	%	<i>n</i>	%		
Are you prepared to be a POW?							
	yes	43	67	41	82	3.79	
	no	15	23	5	10		
	don't know	6	9	4	8		
Do you want to fly in combat?							
	yes	58	91	43	86	0.59	
	no	6	9	7	14		
Do you feel comfortable flying in combat with both genders?							
	yes	62	97	49	98	0.14	
	no	2	3	1	2		
Would you be more protective of one gender in combat?							
	yes	47	73	3	6	54.07	*
	no	16	25	47	94		
	don't know	1	2	0	0		
Has your squadron's mission effectiveness been changed by mixed gender flights?							
	yes	8	13	11	22	3.26	
	no	49	77	37	74		
	unknown	7	11	2	4		
Should pilots have a choice about flying in combat?							
	yes	56	88	41	82	0.67	
	no	8	13	9	18		

DISCUSSION

According to the intelligence scores that were collected, male and female USAF pilots have very high levels of intelligence compared to the general population. IQs in the 120 range represent the top 10% of the general population. While there is some evidence that general population males do better at graphic-spatial type tasks (9), no such result was found in this sample of USAF pilots. Full Scale, Verbal, and Performance IQs of male and female pilots were not statistically different. There were minor differences found with male pilots scoring slightly higher on *Information* and *Picture Completion* subscales. It would appear that intelligence is well screened at earlier points in the selection of pilots and such screening, therefore, does not differ by gender.

Female pilots in the United States Air Force appear to have personalities quite different from male USAF pilots as well as educated women in general. These differences are important as they may relate to recruitment, training, career satisfaction, performance, and career retention. While male pilots are more apt to be characterized as "hot shots," possessing an egocentric "right stuff" tendency, female pilots appear to have more of what may be the "good stuff." Military aviation has changed from the days of dog fighting to multi-crew, highly coordinated missions. In this environment, the higher levels of extraversion, agreeableness, and conscientiousness possessed by current female pilots are far more valued. Aviation, particularly military aviation, is increasingly an interpersonal endeavor and the traits of female aviators nicely fit this demand.

The differences between the female pilots and the "normal" (female) control group are even more interesting. The markedly lower neuroticism of pilots is particularly striking, attesting to the coolness required of any pilot. In general, one does not want a particularly neurotic pilot in any aircraft. Additionally, the female pilots are less open to new experiences. Initial thought may suggest that this is quite counter to the desire to become an Air Force pilot. It must be noted, however, that the military is really quite conservative and "new experiences" are quite controlled. The lower scores on *Neuroticism* and *Openness to Experience* undoubtedly serves a pilot well in terms of not attempting unusual or nonapproved aircraft maneuvers.

The female pilots were, however, higher than the controls on the *Extraversion*, *Agreeableness*, and *Conscientiousness* scales. Again, as was seen with the male pilots, these traits are particularly useful in highly integrated, interpersonal flight situations. For example, when an AWACS aircraft is controlling the flight and combat traffic in an area, extraversion allows for good and frequent communication, agreeableness results in effective crew management (working well with other crew members), and conscientiousness further supports both of those behaviors.

While the female pilots are statistically different from both the male pilots and the female controls, the regressions suggest that they are, indeed, more similar to their male colleagues than similar to females in general. The regression between the male and female

pilots pointed to a 21 percent "difference" in the NEO-FFI testing data. The regression between the female pilots and the female controls suggested a far greater "difference" of 39 percent. As such, it can be concluded from a multivariate perspective the female pilots are indeed more "similar" in personality to male pilots than to females in general.

Adams and Jones (1) noted women's motivation for aviation as an issue worthy of investigation. They examined male aviators' healthy motivation to fly and noted that (male) applicants for flying training have usually thought of becoming pilots since latency or adolescence. Similarly, Morgenstern (14), during a time (1967) when men exclusively flew USAF aircraft, noted that applicants for flying training had usually thought of becoming pilots since school-age or adolescence. Since women's entrance into the service academies, the USAF Academy has become an important avenue for women to enter the aviation career field. Thus, without the newest service Academy, women would have limited access to aviation careers in the USAF.

Medical issues raised during this study warrant a look at those issues found during Project Athena in 1977 (22), when the first women to enter the US Military Academy at West Point were studied. Women suffered more stress fractures during Cadet Basic Training than men at a 10:1 ratio. Women also experienced a higher sick call rate than men. Investigators concluded most women and some men were physically incapable of successfully performing the one-track physical exercise program. Interviews were conducted and health diaries kept by 46 female and 44 male enlisted soldiers who were members of administrative or combat support units in another study (3). The authors reported females identified twice as many health problems as men during the initial interview, but there was no difference in symptom reporting in the health diaries between men and women. When genital symptoms were excluded, the rates of medical problems identified were more similar. Lyons (13) reviewed the medical literature regarding women in the cockpit. He found that while women are probably a better medical risk than men, due to a lessened chance of incapacitation or permanent medical disqualification, women are less likely to report their health as "excellent." Further, women report more symptoms than men and visit physicians more frequently than men. Voge and King (23) report a significantly greater number of women (33%) than men (15%) were grounded longer than 30 days according to the results of their self-report questionnaire. When pregnancy-related groundings are excluded, the women's grounding rate falls to 16%. Similarly, if obstetrical and gynecological groundings were excluded from the current study, the difference in the incidence of medical grounding between men (17%) and women (22%) would be statistically insignificant. Thus, adequate resources for women's medical needs are essential to the health of today's flying squadron.

Devilbiss (6) completed a study of gender integration in a deployed Army unit in 1985. He found evidence of effective male and female bonding of a nonsexual nature. He hypothesized that common experience was crucial, and gender incidental, to interpersonal bonding in this situation. He reported that cohesion is based on the commonality of experience, shared risk, and mutual experiences of hardship, not on gender distinctions. When combat readiness was assessed, unit members who were particularly knowledgeable

were prized, regardless of their gender. Evidence of the successful integration of women into previously all-male military units is demonstrated in our study by the majority opinions that mixed-gender units were more effective and working relationships were positive or neutral.

Project Athena (22) resulted in findings similar to the present study. Men and women both noted career stresses when they perceived inequitable treatment of women, either preferential or harsh. Furthermore, female plebes reported instances of exceptionally harsh treatment. The survey conducted by Voge and King (23) revealed a belief by military female aviators of being openly denied jobs, advances, and benefits due to their gender. Thirty-four percent of women answering their survey believed they were denied a desirable assignment due to their gender, while only six percent of men perceived similar prejudice adversely impacting them.

The present study pointed to some significant issues regarding POW and combat concerns of male and female pilots. In her book detailing her experiences as a POW in Iraq and the experience of sexual assault during her capture, Cornum, an Army flight surgeon writes, "We had heard stories of what the Iraqi soldiers had done to women in Kuwait, so I had thought about the probability that I would be sexually abused if I were captured. I had never considered that I would be so badly injured, though. When I really was shot down, I was thinking of myself as a soldier, and a POW, and a severely injured person. I was not thinking of myself as a woman. I was amazed that this Iraqi soldier could only see me as a woman" (4, p. 50). During this assault she was with a male Army Pathfinder and found herself fearing his reaction more than the rape. She was afraid he would do something "stupid" to defend her and get himself shot. The USAF Academy rape simulation training came under intense criticism by the television program *20-20* in 1995. The training program began after the Gulf War experience. Two cadets interviewed said the training went too far. A total of 24 people complained about the sexual exploitation training. Because of these problems, the USAF Academy changed the training to video tapes in the classroom rather than role play. The concerns of our participants combined with the experiences of Dr. Cornum and the USAF Academy point to a pressing need for adequate training in this area. Open forum discussion about sexual assault and exploitation during survival training may be the most productive approach. Mental health professionals could supervise scenarios and debriefings to include coping strategies for both men and women who might find themselves as either victims or observers in a POW situation.

More than 35,000 female soldiers served in the Persian Gulf War. Eleven women were killed, and two were taken prisoner by Iraqi troops. Sexual harassment and cultural differences and customs surfaced as problems for women. Unsolicited sexual advances, being overprotected and discounted as a real soldier created stress among female soldiers. Physical touching and verbal harassment resulted in American military and Saudi police protection of female troops while outside their tents (24). Thus, while both male and female pilots in our study felt an obligation to fly in combat and do not believe combat is a choice once a person becomes an Air Force pilot, most men have fears for the safety of

female crew members in combat situations. This concern has significant implications for training of aircrew before entering combat situations and during POW resistance training.

Lastly, although men and women in the study report different types of stresses due to differing timelines in family planning, both report similar coping styles. Unfortunately, these coping styles, exercise alone and internalizing personal problems, are not the most efficacious (12), especially when exercise is not possible. Clearly there is a need for better aircrew training in stress coping skills.

CONCLUSION

The flying community is atypical of the general population as demonstrated by the high average to superior IQ and small standard deviations, perhaps due to multiple selection and self-selection forces. Incumbent female pilots seem to have even more of a "good thing" in terms of positive personality traits. We anticipate occupational norms in non-referred pilots will be helpful in future pilot selection, assignment, and retention efforts.

While these male participants may have selected their aircraft based on their preference to work as part of a crew, most of these female participants did not have many options due to the Combat Exclusion Clause in effect at the time of their assignment. Future work should look at how these personality traits directly relate to selection and training as well as to career satisfaction, job performance, and career retention. Given the new emphasis on coordinated, interpersonal flying requirements, it could just be that women make better Air Force pilots than men.

The information gained from this study may assist the USAF in understanding and coping with the psychological stresses associated with combat, deployment, and mixed-gender squadrons. This claim is supported by the significant differences found between men and women in motivation to fly, health care needs, career stresses, POW and combat concerns, and family stresses. An understanding of the similarities and differences in the attitudes and concerns of male and female pilots can help direct training programs and Air Force policy.

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Appendix A
(AF Surgeon General's Endorsement)



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

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13 MAR 1995

MEMORANDUM FOR AF/CC *25* CSAF has seen

FROM: AF/SG
170 Luke Avenue, Suite 400
Bolling AFB DC 20332-5113


SUBJECT: Defense Women's Health Research Program (DWHRP) - Funded Aviator Study

Operational flying units are currently facing challenges not envisioned even five years ago. One of these challenges is the increased number of women in operational settings. The United States Congress has asked the DoD to establish the DWHRP to improve understanding of female performance and stressors facing women in military operations. Armstrong Laboratory (AL) received DWHRP funding to study combat, deployment, and everyday stressors of Air Force pilots in mixed-gender squadrons. For this research to be successful, access to pilot volunteers is crucial. We need your advocacy to ensure this access.

Due to the relatively small number of female pilots in the Air Force, investigators require access to female pilots at AMC, ACC, and AETC to ensure sufficient volunteers for statistical validity. An equal number of male pilot volunteers is also required. The research protocol and a talking paper summarizing the key elements of the protocol are at Attachments 1 and 2, respectively.

Investigators at AL will need 3.5 hours total with each pilot volunteer and scheduling will be at the pilots' convenience as much as possible. Responses will be coded and anonymous; strict confidentiality will be maintained. Individual squadron or wing results will not be reported; however, study feedback will be provided.

I am confident this study will improve our combat capability by understanding the unique needs of male and female aviators. I request your support.


EDGAR R. ANDERSON, JR.
Lieutenant General, USAF, MC
Surgeon General

- Attachments:
1. Research Protocol
 2. Talking Paper

Appendix B

(Chief of Staff of the Air Force Endorsement)



DEPARTMENT OF THE AIR FORCE
OFFICE OF THE CHIEF OF STAFF
UNITED STATES AIR FORCE
WASHINGTON DC 20330

27 MAR 1994

~~MEMORANDUM~~ ^{SKIP} FOR AMC/CC

FROM: HQ USAF/CC
1670 Air Force Pentagon
Washington DC 20330-1670

SUBJECT: HQ AMC Support of Armstrong Laboratory (AL) Study

HQ USAF/SG has requested assistance in accomplishing a study entitled, "Psychological Assessment in Aviators" (Attached). This is an important protocol, funded through the Defense Women's Health Research Program, which may yield valuable information on mixed-gender squadron operations. Charleston AFB, SC, Fairchild AFB, WA, McChord AFB, WA, McConnell AFB, KS, McGuire AFB, NJ, and Travis AFB, CA have a number of female pilots assigned, and their voluntary participation will help complete this study. I ask you to encourage Wing POCs to contact the AL. POCs at AL are Major Suzanne McGlohn or Captain Raymond E. King at DSN 240-3537.

A large, stylized handwritten signature in black ink, likely belonging to Ronald R. Fogleman, is positioned above the typed name.

RONALD R. FOGLEMAN
General, USAF
Chief of Staff

Attachment:
HQ USAF/SG Ltr